Bereskin & Parr
INTELLECTUAL PROPERTY LAW

Appl. No	: 09/425,234	Confirmation No.: 9266
Applicant	: RABIE et al.	
Filed	: October 25, 1999	
Title	: MAINTENANCE CLEANING FOR MEMBRANES	
TC./A.U.	: 1723	
Examiner	: MENON, Krishnan S.	
Docket No.	: 4320-091	
Customer No.	: 001059	

Board of Patent Appeals and Interferences
United States Patent and Trademark Office
P. O. Box 1450
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BRIEF IN SUPPORT OF APPEAL

Real Party in Interest

The Real Party in Interest in the present Appeal is Zenon Environmental Inc., the assignee, as evidenced by the assignment set forth at Reel 012977, Frame 0477.

Related Appeals and Interferences

This appeal is related to appeals pending in Application Nos. 09/966,247 and 10/461,687. There have not been any decisions rendered in either of these Appeals as of the date of this Brief.

Status of Claims

Claims 18-26 were cancelled before the Final Action. In accordance with 37 CFR 41.33(b)(1), claims 1-4 and 27-38 are being cancelled in a separate paper filed with this Brief in Support of Appeal. Claims 5 to 17 remain pending and are being appealed. A copy of the appealed claims appears in the Claims Appendix.

Status of Amendments

An amendment is being filed with this Appeal Brief canceling claims 1-4 and 27-38. No other amendments have been filed subsequent to Final Rejection.

Summary of the Claimed Subject Matter

The claimed invention relates to a method of cleaning one or more membranes normally immersed in water containing solids in a tank (page 5, lines 17-19 and 21-25; "membranes 24", "tank water 22", "tank 20" shown in Figure 1). The one or more membranes are arranged into one or more modules such that permeate sides of the one or more membranes enclose a space in communication with one or more headers of the one or more modules (page 6, lines 15-19; "permeate side 25", "headers 26" and "module 28" shown in Figure 1). The membranes are used to produce a filtered permeate (page 6, lines 24-27; "permeate 36" shown in Figure 1). As water from the tank flows through the membranes, solids in that water are rejected by the membranes (page 7, lines 14-17). Thus, during permeation, water with a reduced concentration of solids (permeate) is presented in the enclosed space of the modules. This permeate flows to the headers from where it can be removed from the tank (page 6, lines 26-27). However, during permeation the membranes become dirty or fouled (page 8, lines 1-2). If permeation simply continued, the fouling would eventually cause the permeability of the membranes to decline to an unacceptable level. The claimed invention addresses this issue by providing a method of cleaning the membranes.

Claim 5 relates to a method of cleaning having cleaning events, the cleaning events having three basic steps as set out below:

(a) stopping permeation (page 9, lines 25-28);

(b) after stopping permeation and before resuming permeation, flowing a chemical cleaner to the one or more headers in a series of pulses, wherein the pulses are separated from each other by waiting periods in which the flow of chemical cleaner is stopped (page 14, line 28 to page 15, line 14);

(c) after step (b), resuming permeation (page 17, lines 14-16);

These three steps are performed according to the following qualifications specified in claim 5:

(d) the membranes remain immersed in the water containing solids while the chemical cleaner flows to the one or more headers (page 15, lines 6-8);

(e) the outside of the membranes is in fluid communication with the water containing solids (page 6, lines 15-18); and,

(f) during step (b), all chemical cleaner reaching the one or more headers remains in the enclosed space of the one or more modules or flows through the walls of the membranes in a direction opposite to the direction in which permeate normally passes through the walls of the membranes (page 9, lines 25-30).

As set out above, claim 5 includes in step (b) flowing a chemical cleaner to the one or more headers in a series of pulses separated from each other by waiting periods in which the flow of chemical cleaner is stopped. As specified in part (f) of the claims, during step (b) all chemical cleaner reaching the one or more headers remains in the enclosed space of the one or more modules or flows through the walls of the membranes in a direction opposite to the direction in which permeate normally passes through the walls of the membranes. Delivering the chemical cleaner in pulses separated by waiting periods as in part (b) of claim 5 under the dead end flow regime of part (f) of claim 5 allows a higher pressure to be used to deliver the chemicals which assists in reducing the relative size of head variations or pressure losses in the system and provides a more even distribution of chemical cleaner across the surface of the membranes (page 14, lines 10-17). The waiting periods also allow the chemical cleaner time to react with the foulants before delivery of more chemical cleaner pushes the earlier applied cleaner out of or away from the membranes (page 14, lines 2-8; page 15, lines 15-22).

Claims 6-17 depend on claim 5 and add additional limitations to claim 5.

Claim 6 states that the cleaning events of claim 5 are repeated generally periodically at a frequency between 1 and 7 times per week between more intensive first cleanings performed at least 15 days apart (page 12, lines 11-15; page 13, lines 15-21). Claim 7 depends on claim 6 and provides a "weekly CT" for the cleaning events, that is a sum of the product of the concentration of the cleaning chemical and the time during which the

chemical cleaner remains effective in the area adjacent the membranes (page 12, lines 2-10 and 21-22) for all cleaning events performed in a week.

The method described in claims 6 and 7 is called "maintenance cleaning" and described, for example, at page 8, line 1, to page 9, line 12, and page 12, lines 11-20 of the specification. As described in the specification, the cleaning events of claim 5 may be intentionally designed so that they are insufficient to keep the permeability of the membranes from declining over large periods of time. However, because the cleaning events may be performed quickly and provide minimal damage to the membranes or disruption to the water treatment process, the cleaning events can be performed frequently. The frequent small cleaning events act as a preventative measure and serve to extend the time between necessary, but harsher and more disruptive, intensive cleanings.

Claims 8-10 further limit the range of weekly CT of claim 7 (page 12, line 21 to page 13, line 4). Claims 11-13 further define the duration of the pulse steps and waiting periods (page 14, line 28 to page 15, line 1). Claims 14 and 15 define the pressure of the pulses (page 4, lines 25-27) and the resulting flow of chemical cleaner through the membranes (page 15, lines 3-6). Claims 16 and 17 describe a process according to claim 5 having an additional step of removing chemical cleaner from the tank through a drain in the tank before permeation is resumed (page 17, lines 8-11).

Grounds of Rejection to be Reviewed on Appeal

1. Double Patenting

Claims 5-17 were provisionally rejected for obviousness type double patenting in view of various claims of Application Serial Nos. 10/377,647 and 10/461,687.

2. Rejections Under 35 USC 103

Claims 5 to 15

Claims 5 to 15 were rejected as being obvious in view of Smith et al., U.S. Patent No. 5,403,479 (Smith '479). In relation to step (b) of claim 5, the delivery of chemical cleaners in pulses separated by waiting periods, the Examiner alleges that Smith '479

teaches a form of pulsed flow that one of skill in the art could optimize depending on the nature of water treated to produce the claimed limitation. The Examiner further alleges that Smith '479 teaches, at col. 11, lines 22-60, a "back-flush mode" of cleaning which given the Examiner's interpretation of how the module in Smith '479 is arranged, would result in flow as described in part (f) of claim 5. The Examiner further alleges that claims 7-15 are optimizations of result effective variables, disclosed in Smith '479 or inherent in Smith '479.

Claims 16 to 17

Claims 16 and 17 were rejected as being obvious in view of Smith '479 in view of Applicant's alleged admission of known prior art, and further in view of Kawanishi et al. (U.S. Patent No. 5,647,988). The Examiner does not state what the Applicant's alleged admission is or how it relates to the claims. In relation to Smith '479, the Examiner alleges that, although Smith teaches that draining the tank is unnecessary, Kawanishi teaches draining after cleaning when excessive amounts of cleaning agent are used.

ARGUMENT

Double Patenting

Applicants filed a Terminal Disclaimer in relation to applications 10/377,647 and 10/461,687 on March 15, 2005 which was approved. The Applicants submit that this rejection no longer applies.

Claim Rejections Under 35 USC 103

Claim 5

The Appellants submit that Smith does not make claim 5 obvious, particularly because Smith '479 does not teach a process having step (b) of claim 5 according to the limitation of step (f) of claim 5. In combination, these parts of claim 5 require a dead end, or non-recirculating, flow of chemical cleaner into the module and through the membrane walls in pulses separated by waiting periods in which the flow to the module is stopped. The Appellants submit that the Examiner has misinterpreted the flow regime of the chemical cleaner taught in

col. 11, lines 22-60, of Smith and that the Examiner's further citations in relation to "pulsed flow" are irrelevant or at least do not provide prima facie evidence of obviousness.

In column 11, lines 22-60, Smith describes a method of cleaning a module including a step of "introducing chosen cleaning fluid into the permeate and recycling it through the lumens (lines 25-27)". Figure 2 and column 17, lines 7-44 show what is meant by "recycling" the cleaning fluid. In particular, the cleaning fluid is taken from a tank 27, flows to a first header 11 of modules 10, flows from the first header 11 through the lumens of the membranes 12 to a second header 11' and then flows back to tank 27. When the chemical cleaner is being recycled or circulated into and out of the module in this manner, the flow of the chemical is optionally driven according to one of two flow regimes, both having a low pressure, but one having a pressure that is "substantially constant" and the other having a pressure "deliberately varied within a period of less than 5 sec, preferably less than 1 sec." (col 11, lines 35-37)

The Examiner alleges that col 11 of Smith provides the limitation of part (f) of claim 1 that, "all chemical cleaner reaching the one or more headers remains in the enclosed space of the one or more modules or flows through the walls of the membranes in a direction opposite to the direction in which permeate normally passes through the walls of the membranes". However, it is clear that some cleaning chemical in the method of Smith leaves the module to flow back to tank 25. Smith '479 says explicitly in the lines directly following the Examiner's reference (col. 11, lines 63-63) that, "the clean-in-place process of this invention does not dead-end the fibers to be cleaned". Accordingly, not all of the chemical cleaner reaching the one or more headers remains in the enclosed space of the one or more modules or flows through the walls of the membranes and part (f) of claim 1 is not met.

For the reasons above, the Applicants submit that the method described in Smith column 11 is not relevant to claim 5. Accordingly, optimizing the process

described at col. 11, lines 35-50, depending on the nature of water treated will not obviously lead to step (b) of claim 5 as alleged by the Examiner. Further, Smith '479 does not teach anything about how a change in the nature of the water being treated would change how the chemical cleaner is delivered to the module. In particular, the Appellants submit that the Examiner's supporting references are irrelevant or otherwise fail to provide a prima facie case of obviousness. Col. 12, line 68 to col. 13, line 5, relates to a further alternate process in which a chemical cleaner is held in the lumens of the membranes. This process is unconnected to the process of Smith '479 col. 11, lines 35-46. Col. 14, lines 55-68 relates to a "soak period" also unconnected with the process of col. 11, lines 35-46 of Smith '479 and to the choice of chemical, neither of which support the Examiner's theory of optimization depending on the nature of the water to be treated. Col. 16, line 60 to col. 17, line 6 relates explicitly to a recirculating flow process (lines 63-64) and teaches that the purpose of pulsing is related to avoiding diffusion flow through the membrane pores during recirculating flow. This is contrary to flow according to step (f) of claim 5 and fails to support the Examiner's optimization theory in relation to part (b) of claim 5.

Claim 6

The Examiner rejects claim 6 on the basis that claim 6, "adds the more intensive recovery cleaning as being 15 days apart, which is a result effective variable (In re Boesch)". The Applicants submit that this rejection fails to establish a prima facie case. Claim 6 adds that the cleaning events of claim 5 are performed generally periodically at a stated frequency between more intensive first cleanings performed at another stated frequency. Smith '479 does not teach a combination of cleaning events, some as defined in claim 5, and some being more intensive and performed less frequently. Since Smith '479 does not teach the basic process of claim 6, no optimization of the process in Smith '479 will produce a process of claim 6 further having the cleaning frequencies stated in claim 6. In contrast, Smith '479 is concerned with restoring the flux of the

membranes to above a threshold level at each cleaning (col 12, lines 26-55). Optimization of the Smith '479 process is therefore unlikely to produce a process in which more intensive cleanings are periodically required at all.

Claims 7 to 10

Claims 7 to 10 depend on claim 6 and the Examiner again alleges that they relate to a result effective variable. Again, since the process of claim 6 is not provided in Smith '479, the Examiner has not established a prima facie case that the weekly CT claimed is merely the optimization of a result effective variable in the process of Smith '479. In contrast, Smith '479 is concerned with cleaning of the membranes to restore their flux (col. 12, lines 26-55) not to merely extend the time between necessary more intensive cleanings. Optimizing a process according to Smith's teaching is therefore unlikely to produce a CT parameter in the range claimed in the context of the process of claim 6.

Claims 11 and 12

Claims 11 and 12 define pulse and waiting period durations. The Examiner again rejects these claims as relating to the optimization of a result effective variable despite Smith '479 not relating to the claimed process. Further, to the extent that Smith discusses some form of pulsing, Smith '479 states that pressure may be varied, "with a period of less than 5 sec, preferably less than 1 sec". The Applicants submit that this teaches away from claims 11 and 12 which recite the periods of about an order of magnitude more.

Claim 13

Regarding claim 13, the Examiner cites a general discussion of the action of a cleaning chemical which does not make the claimed length of pulse step and waiting period obvious.

Claim 14

Regarding claim 14, the Examiner cites pressures from col 11 of Smith which relate to a process in which the cleaning chemical recirculates through the

membrane lumens and out of the membrane module. The Applicants submit that this is irrelevant to claim 14 which, because it depends on claim 5, requires that chemical cleaner not recirculate through the lumens as in Smith '479.

Claim 15

Regarding claim 15, the flow through the membrane walls in Smith '479 is not inherent in the device but a function of the permeability of the membranes used, the applied pressure, the length and internal diameter of the membranes and the flow regime, in Smith '479, which provides for flow into and out of the module through a second header. Claim 15, because it depends on claim 5, does not relate to a system where chemical cleaner flows out of a module through a second header and so relates to a different mode of operation. For this reason, and because Smith does not describe the membranes well enough to know what flow would occur through them, the inherency argument fails.

Claims 16 and 17

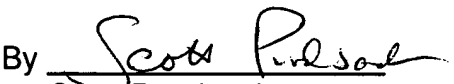
Regarding claims 16 and 17, the Examiner states that Smith teaches that draining the tank is unnecessary at col 11, lines 50-60. The Applicants submit that Smith '479 does not say that draining the tank is unnecessary, but rather that draining the tank is not done in their process (see for example col 11, lines 24-25) and that draining the tank is an undesirable aspect of some prior art processes (col 10, lines 59-68). This teaches away from claims 16 and 17. The Examiner also refers to Kawanshi, col 1, lines 15-63. However, this passage describes emptying a tank so that the tank may be refilled with a chemical solution to apply the chemical to the outsides of the membrane. Such a process has nothing to do with a process in Smith '479 wherein a chemical cleaner is applied to the insides of the membranes while the outsides of the membranes remain in contact with the water being treated. Further, Smith '479 describes such a process analogous to that of Kawanishi col 1, lines 15-63 as "highly undesirable" (col 10, lines 59-68). Accordingly, the Applicants submit that it would

not be obvious to combine the cited references in a manner that would produce the claimed invention.

For the reasons above, the Applicants respectfully submit that the rejection of claims 5-17 is in error and requests reversal of these rejections.

Respectfully submitted,

BERESKIN & PARR

By 

Scott Pundsack
Reg. No. 47,330
Tel: 416-957-1698

CLAIMS APPENDIX

5. A method of cleaning one or more membranes normally immersed in water containing solids in a tank, the one or more membranes arranged into one or more modules such that permeate sides of the one or more membranes enclose a space in communication with one or more headers of the one or more modules, and used to produce a filtered permeate comprising:

performing cleaning events having the steps of:

(a) stopping permeation;

(b) after step (a), and before resuming permeation, flowing a chemical cleaner to the one or more headers in a series of pulses, wherein the pulses are separated from each other by waiting periods in which the flow of chemical cleaner is stopped;

(c) after step (b), resuming permeation;

wherein

(d) the membranes remain immersed in the water containing solids while the chemical cleaner flows to the one or more headers;

(e) the outside of the membranes is in fluid communication with the water containing solids; and,

(f) during step (b), all chemical cleaner reaching the one or more headers remains in the enclosed space of the one or more modules or flows through the walls of the membranes in a direction opposite to the direction in which permeate normally passes through the walls of the membranes.

6. The method of claim 5 wherein the cleaning events are repeated generally periodically at a frequency between 1 and 7 times per week between more intensive first cleanings performed at least 15 days apart to increase the permeability of the membranes.

7. The method of claim 6 wherein

(i) each cleaning event has a CT which is equal to (A) the concentration of the chemical cleaner expressed as an equivalent concentration of NaOCl in cleaning efficacy multiplied by (B) the time during which the chemical cleaner remains effective in the area adjacent the membranes; and,

(ii) the cleaning events have a weekly CT which is equal to the sum of the CT's of the one or more cleaning events performed in a week and is between 2,000 minutes•mg/L and 30,000 minutes•mg/L;

8. The method of claim 7 wherein the weekly CT is between 2,000 minutes•mg/L and 20,000 minutes•mg/L.

9. The method of claim 6 wherein the permeate is intended for drinking water and the weekly CT is between 5,000 minutes•mg/L and 10,000 minutes•mg/L.

10. The method of claim 6 wherein the water containing solids is a wastewater and the weekly CT is between 10,000 minutes•mg/L and 30,000 minutes•mg/L.

11. The method of claim 5 wherein the pulse steps last for between 10 seconds and 100 seconds and the waiting periods last for between 50 seconds and 6 minutes.

12. The method of claim 5 wherein the pulse steps last for at least 10 seconds and the waiting periods last for at least 50 seconds.

13. The method of claim 5 wherein the length of the pulse steps is selected to provide chemical cleaner in an area in the membranes and in an area in tank water adjacent the outside of the membranes with an initial efficacy and the length of the waiting periods is selected to provide substantially effective chemical cleaner in an area in the membranes and an area in tank water adjacent the outsides of the membranes during the waiting period.

14. The method of claim 5 wherein the membranes are hollow fibre membranes and the pressure of the cleaning chemical in the pulse steps is between 5 kPa and 55 kPa above the pressure on the outside of the membranes.

15. The method of claim 14 wherein the flow through the membranes during the pulse steps is between 8.5 and 51 $L/m^2/h$.

16. The method of claim 5 wherein chemical cleaner is removed from the tank through a drain in the tank before permeation is resumed.

17. The method of claim 16 wherein substantially all of the chemical cleaner is removed from the tank through a drain in the tank before permeation is resumed.